ENHANCEMENT OF THE IMPLEMENTATION OF THE HIGH SPEED CELL FACH/RACH FEATURE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit under 35 U.S.C. §119(e) of U.S. Provisional Patent Application No. 61/885,232, filed on Oct. 1, 2013, the disclosure of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] This invention relates generally to WCDMA/HSPA systems and, more specifically, relates to packet data transfer in such systems.

BACKGROUND

[0003] This section is intended to provide a background or context to the invention disclosed below. The description herein may include concepts that could be pursued, but are not necessarily ones that have been previously conceived, implemented or described. Therefore, unless otherwise explicitly indicated herein, what is described in this section is not prior art to the description in this application and is not admitted to be prior art by inclusion in this section. Abbreviations that may be found in the specification and/or the drawing figures are defined at the end of this document.

[0004] A WCDMA/HSPA terminal can be in two different modes. For instance, the terminal is in Idle mode when there are no radio resources allocated to the terminal. In this case, the radio network is not aware of the terminal. The terminal is in Connected mode when the radio network is aware of the terminal location and some resources are assigned to the terminal. In the Connected mode, the terminal can be in four different states as indicated in FIG. 1.

[0005] In the Cell_DCH state, the terminal has dedicated resources, and in this state the terminal can use the high speed shared channel. The highest data rates can be reached in this state. When the terminal has no more data to send or receive and after expiration of an activity timer, the terminal is moved to the Cell_FACH state.

[0006] Up to 3GPP release 6, the terminal could send small amount of data in the Cell_FACH state. When inactivity is long (e.g., based on expiration of an activity timer), the terminal is moved to the Cell_PCH or URA_PCH state. The benefit of Cell_FACH, Cell_PCH and URA_PCH states for the terminal is low battery consumption, as the terminal in those states monitors a limited number of radio channels.

[0007] The introduction of High Speed (HS) Cell_FACH feature in 3GPP release 7 for downlink and release 8 for the uplink allows the use of high speed channels in Cell_FACH state too. The High Speed Cell_FACH feature is also referred to as the Enhanced Cell_FACH, the Enhanced FACH, the Enhanced RACH, or the HS_FACH. A HS_FACH user equipment is a 3G terminal equipment that supports the HS_FACH feature.

[0008] The benefits of this new feature include the following:

[0009] Improvement of the quality of experience of the users, as access to data is faster; and

[0010] Support of more users in the Cell_FACH state, which reduces the signaling load on the RNC.

[0011] Without the feature, a terminal in a dormant Cell_PCH state needs to move to the Cell_DCH state before receiving or transmitting data, and for this transition a lot of signaling messages are exchanged between the terminal and the radio network (e.g., NodeB/RNC), this can take up to 600 ms.

[0012] With the HS_FACH feature, the terminal is moved from the Cell_PCH state to the Cell_FACH state, where the terminal can start using high speed data. Fewer signaling messages are needed for this transition and this transition takes about 150 ms.

[0013] FIG. 2 shows a delay before data transmission in case of a UE transition from the Cell_PCH state to the Cell_DCH state and in case of a transition from the Cell_PCH state to the Cell_FACH state for only one UE in a cell. Because of less signaling needed when terminals are kept longer in the Cell_FACH state, the new feature reduces significantly the signaling load of the RNC.

[0014] However, improvements in use of this feature could be made.

SUMMARY

[0015] This section is intended to provide examples and is not meant to be limiting.

[0016] In an example, a method includes adapting a high speed Cell_FACH feature to a load of a cell. The adapting is performed at least by changing a value of a data volume threshold corresponding to HS_FACH user equipment so delay experienced by a user equipment in a Cell_FACH state is kept lower than a delay the user equipment would experience if moved to a Cell_DCH state. The value of the data volume threshold determines a data volume that, if not exceeded, causes a user equipment to be kept in the Cell_FACH state. The method includes deciding for each user equipment in the Cell_FACh state whether to keep the user equipment in the Cell_FACH state or move the user equipment to the Cell_DCH state. The deciding for each user equipment is based at least on the changed value for the data volume threshold and a data volume for the user equipment.

[0017] Another exemplary embodiment is an exemplary apparatus that includes one or more processors and one or more memories including computer program code. The one or more memories and the computer program code are configured to, with the one or more processors, cause the apparatus to perform at least the following: adapting a high speed Cell_FACH feature to a load of a cell, the adapting performed at least by changing a value of a data volume threshold corresponding to HS_FACH user equipment so delay experienced by a user equipment in a Cell_FACH state is kept lower than a delay the user equipment would experience if moved to a Cell_DCH state, where the value of the data volume threshold determines a data volume that, if not exceeded, causes a user equipment to be kept in the Cell_FACH state; and deciding for each user equipment in the Cell_FACh state whether to keep the user equipment in the Cell_FACH state or move the user equipment to the Cell_DCH state, the deciding for each user equipment based at least on the changed value for the data volume threshold and a data volume for the user equipment.

[0018] A further exemplary embodiment is an exemplary computer program product that includes a computer-readable storage medium bearing computer program code embodied therein for use with a computer. The computer program code includes: code for adapting a high speed Cell_FACH feature to a load of a cell, the adapting performed at least by changing